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ABSTRACT

This booklet was developed for industrial arts students who demonstrate a need for additional instruction in mathematics, with the focus on the content needed for drafting. The eight topics included are: how to read a ruler, reading a one-fourth inch scale, multiplication of whole numbers, how to find square footage from an architectural floor plan, two plastic triangles used as drafting tools, centering a drafting isometric problem, a quick way to figure radius settings when using the drafting compass, and using fractions and decimals in the drafting class. Each topic lists teacher materials (concepts, instructions, and related activities) and provides several worksheets for students. To identify students who need additional help, a Basic Skills Checklist is provided for the teacher, and a Basic Skills Verification Form is included to enable the teacher to ask resource teachers and counselors to verify the identification and to provide instructional help. The materials may be used as instruction for the entire class, as a take-home, parent involvement assignment, or in a mathematics laboratory. (MNS)

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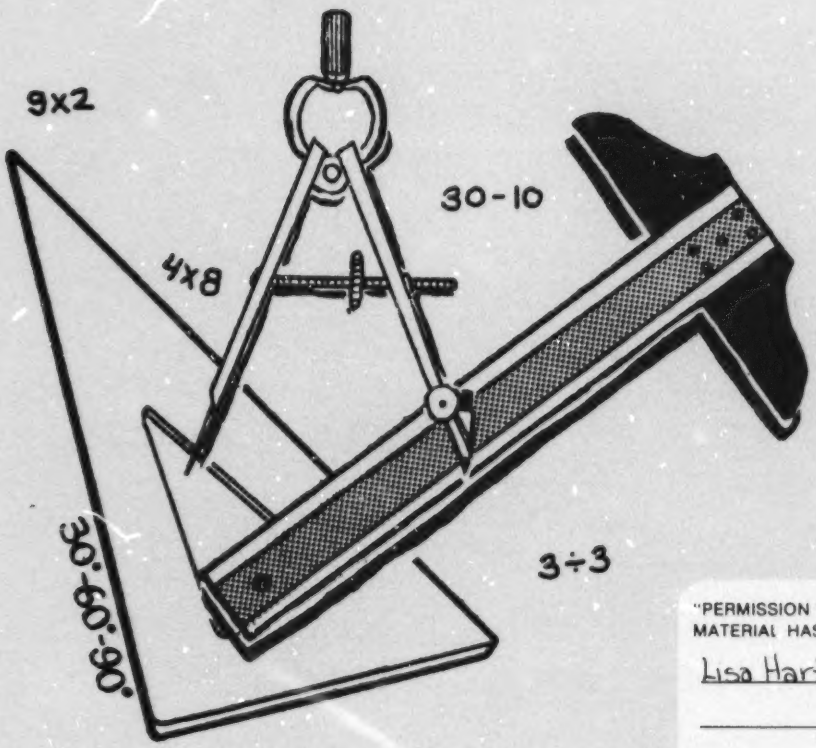
FIELD TEST COPY

"LEARNING TO DO MATH THE DRAFTING WAY"

ED251300



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INDUSTRIAL EDUCATION INSERVICE PROJECT

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Office of Vocational Education
Field Operations Section
Industrial Education Unit

and

California State University - Los Angeles
Industrial Studies Department

SE 045 249

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INTRODUCTION

These instructional techniques were developed for those industrial education students who demonstrate a need for additional instruction in the areas of reading, writing, math, verbal and visual communication. They were written by industrial education teachers with a particular emphasis upon teaching a basic skill while retaining a major focus on the subject areas of auto, woods, metals, electronics, and drafting.

Each of these instructional techniques were written using the same format and with guidance from an expert in the areas of reading, writing, math, verbal and visual communication.

In order to help you identify those students who require additional help with the basic skills, a simple easy-to-use BASIC SKILLS CHECKLIST is provided with each subject area module. This Basic Skills Checklist will enable you as the Industrial Education Teacher to better identify those students in your classes who require additional help in the basic skills.

Additionally, a BASIC SKILLS VERIFICATION FORM is provided which will enable you to ask your school's reading resource teacher, basic skills teacher, math resource teacher, Hart Bill Conferencing teacher, or grade counselors, to verify your identification and provide you with help in the instruction of the basic skills.

You may wish to use these techniques as instruction for your entire class, or as a take-home, parent-involvement assignment. They may also be used in your school's reading or math lab or in conjunction with your school's basic skills instructional programs.

These instructional techniques are successful because your students are able to relate reading, writing, math, verbal and visual communication to their own industrial education classes. When your students succeed, they feel good about themselves, good about their schools, and good about their future.

Name _____

CONFIDENTIAL Grade _____ Class _____

Date _____

BASIC SKILLS CHECKLIST (DRAFTING)

The following is a list of the basic skills (reading, writing, math, verbal & visual communication) that the student should demonstrate an ability in for the purpose of employment or advanced training in the drafting field.

1.0 Verbal Communication: The student needs additional instruction in verbal communication if any of the items below are checked NO:

1.1 Yes ____ The student understands verbal instructions given by the teacher.

No ____

Example: Does the student select the correct drawing sheet size after receiving verbal instruction on which size to use?

1.2 Yes ____ The student asks questions about verbal instructions or information not understood.

No ____

Example: Does the student ask questions about the use of drafting equipment when it appears that the instruction given was not understood?

1.3 Yes ____ The student is able to relay simple verbal instructions to another student.

No ____

Example: Is the student able to show a new student how to fasten a drawing sheet to the drawing board or table?

1.4 Yes ____ The student is able to verbally communicate with the teacher.

No ____ Example: Is the student able to explain to the teacher why certain views were selected to illustrate and describe an object?

2.0 Writing: The student needs additional instruction in writing if any of the items below are checked NO:

2.1 Yes ____ The student is able to write basic instructions to self and others.

No ____ Example: Is the student able to fill out a work order or a descriptive log on each drawing assignment?

2.2 Yes ____ The student is able to write the answers to questions.

No ____ Example: After a student has demonstrated that they can answer questions orally, can they write the answers on paper?

3.0 Reading: The student needs additional instruction in reading if any of the items below are checked NO:

3.1 Yes ____ The student is able to read and understand job related materials.

No ____ Example: Does the student's responses to written test and informal oral questions indicate that they understand written materials contained in textbooks or instruction sheets?

3.0 Reading (Continued)

3.2 Yes ____ The student is able to follow step by step procedures on instruction or job sheets.

No ____

Example: Is the student able to perform tasks in sequence after being given a demonstration and a procedure sheet to follow?

4.0 Math: The student needs additional instruction in math if any of the items below are checked NO:

4.1 Yes ____ The student is able to read a rule to increments of 1/16th inch.

No ____

4.2 Yes ____ The student understands relationships between fractions and decimals.

No ____

Example: Is the student able to use a conversion chart to convert fractions to decimals?

4.3 Yes ____ The student understands basic geometric construction.

No ____ Example: Is the student able to lay out basic geometric constructions such as: bisecting an arc, drawing a hexagon, drawing a tangent arc, etc.?

4.4 Yes ____ The student can add and subtract whole numbers and fractions.

No ____ Example: Is the student able to add and subtract whole numbers and fractions while dimensioning drawings?

5.0 Visual Communication: The student needs additional instruction in visual communication if any of the items below are checked NO:

5.1 Yes ____ The student understands the relationship between drawings and manufactured products.

No ____

Example: Given the tools and shop skills, is the student able to construct a simple item from a sketch or drawing?

IDENTIFICATION Made by: _____

BASIC SKILLS VERIFICATION FORM

Student _____ Male____ Female____ Grade Level____

Teacher _____ Class_____ Date_____

The Basic Skills Check List (attached) for the above student indicates a need for instructional assistance in the basic skills (reading, writing, math, verbal or visual communication). The following verification and recommendations are made:

____Lacks Reading Skills

____Lacks Writing Skills

____Lacks Mathematical Skills

____Lacks Verbal Communication Skills

____Lacks Visual Communication Skills

METHOD USED FOR VERIFICATION

Recent Test Scores:

Test	Score	Date
_____	_____	_____
_____	_____	_____
_____	_____	_____

Other Verification Methods:

_____

_____

RECOMMENDATIONS

The following instructional assistance is recommended: _____

_____

Verification & Recommendations Made By: _____ Date: _____

Title: _____

_____

_____

FOLLOW UP

Action Taken: _____

Results: ____Qualified for advanced training

____Qualified for employment in the trade

____Other_____

Certified by: _____ Date: _____
Teacher

HOW TO READ A RULER

(Reading a Ruler)

DRAFTING MATH 1

HOW TO READ A RULER

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the skill of reading a ruler.

b. What student learning problem(s) prompted the development of this technique?

Many students cannot read a ruler. These students will become frustrated until they learn how to read and understand a ruler.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Give each student the enlarged ruler handout showing the breakdown of the different parts of an inch.

b. Draw on the blackboard the individual fractions within one inch.

1. Show that one inch has four (4) equal parts (1/4).

2. Show that one inch has eight (8) equal parts (1/8).

3. Show that one inch has sixteen (16) equal parts (1/16).

c. Review with a large overlay chart or overhead projector the different parts of a ruler.

d. Explain the association of money and parts or fractions of an inch. Use quarters to show this: one quarter = 1/4 of a dollar or 25¢, 2 quarters = 1/2 of a dollar or 50¢, 3 quarters = 3/4 of a dollar or 75¢ and 4 quarters = 4/4 of a dollar or $1.00.

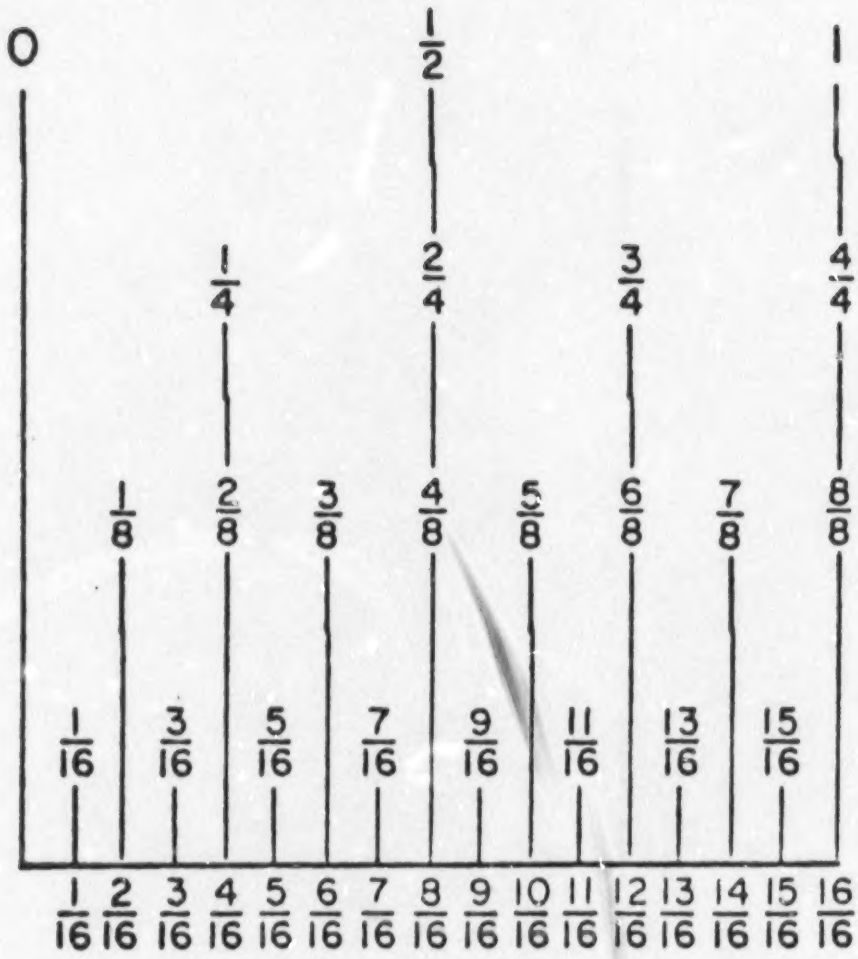
e. As a review, draw different measurements on the blackboard and ask students in class to read the measurement aloud.

f. For those students who have trouble reading a ruler assign them this technique.

3. SUGGESTED RELATED ACTIVITIES:

Ask your students to make measurements off of other drawings. 1.1

PARTS OF AN INCH



1.2

HOW TO READ A RULER

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Use your ruler to measure each line on the "How to Read a Ruler Worksheet".

b. Write your answers on the answer sheet found on STUDENT PAGE 3.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 AND 3.

3. EXTRA THINGS THAT YOU CAN DO:

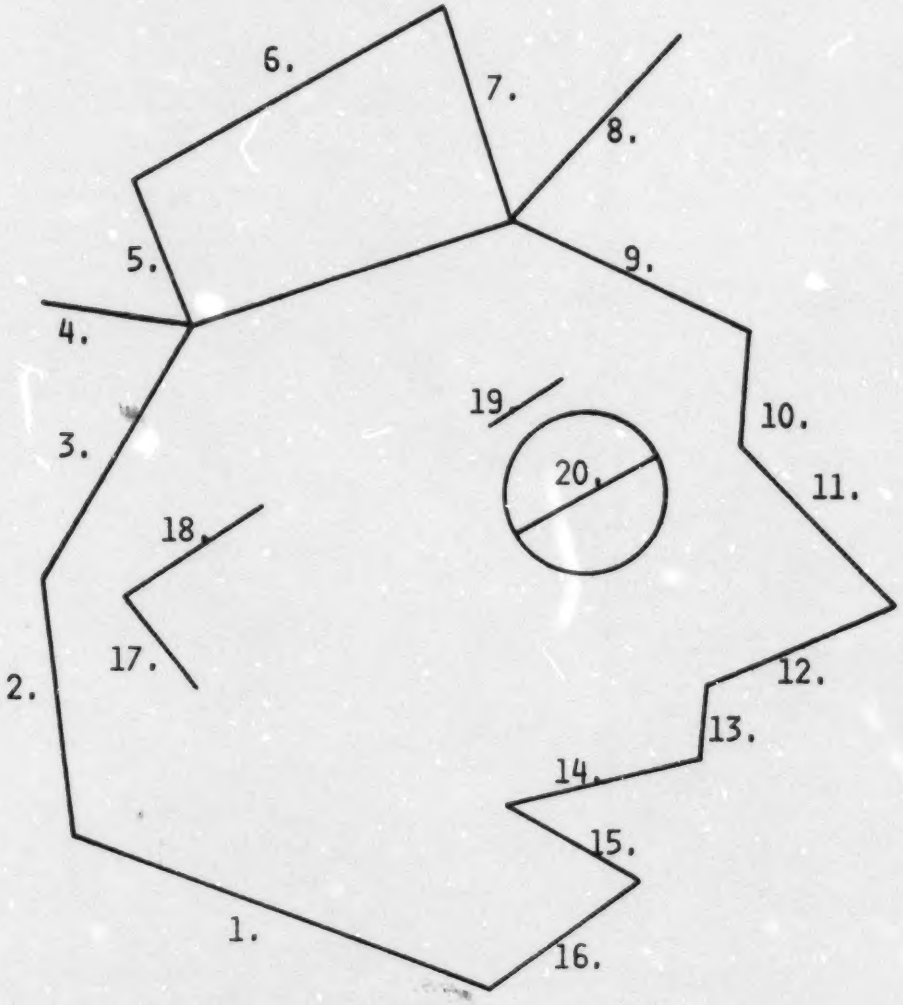
a. Draw ten (10) straight lines of different lengths, less than 12 inches long. Measure them and have a friend check your answers.

b. Measure the distance from one city to another in inches using a California road map.

HOW TO READ A RULER WORKSHEET

DIRECTIONS: Using your ruler measure each line that makes up the figure shown on this sheet.

Write your answers on the answer sheet found on STUDENT PAGE 3.



DO NOT WRITE ON THIS SHEET

HOW TO READ A RULER ANSWER SHEET

Use the symbol for inches (") when you write your answers, for example: 1 inch = 1".

1. _____ 11. _____

2. _____ 12. _____

3. _____ 13. _____

4. _____ 14. _____

5. _____ 15. _____

6. _____ 16. _____

7. _____ 17. _____

8. _____ 18. _____

9. _____ 19. _____

10. _____ 20. _____

READING A 1/4 INCH SCALE

(Reading an Architectural Scale)

DRAFTING MATH 2

READING A 1/4 INCH SCALE

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach how to read an architect scale where 1/4 inch equals one foot.

b. What student learning problem(s) prompted the development of this technique?

Students are unable to read a 1/4 inch scale.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Using a wall chart that depicts an enlarged 1/4 inch scale, explain the markings on the scale.

b. Explain how measurements are made using this type of scale.

c. Pass out to your students the "Reading a 1/4 Inch Scale" Information Handout. Have them complete these sheets and then return the assignment to you.

3. SUGGESTED RELATED ACTIVITIES:

Have your students find dimensions on a floor plan which is in 1/4 inch scale.

READING A 1/4 INCH SCALE

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Read the Information Handout found on STUDENT PAGE 2.

b. Complete the measurement problems found on STUDENT PAGE 3.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 AND 3.

3. EXTRA THINGS THAT YOU CAN DO:

Look at an architect scale that has different scales such as 1/8" equals 1 foot. List all the scales you find.

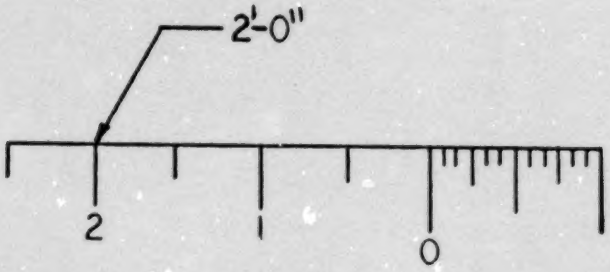
INFORMATION HANDOUT

READING A 1/4 INCH SCALE

1. Look at the 1/4" scale below. Notice that each of the numbers represents a certain foot increment. The 2 equals 2 feet, the 4 equals 4 feet, etc. Between each of these numbers are 1 foot increments.

   To measure feet, start at the zero and measure to the left.

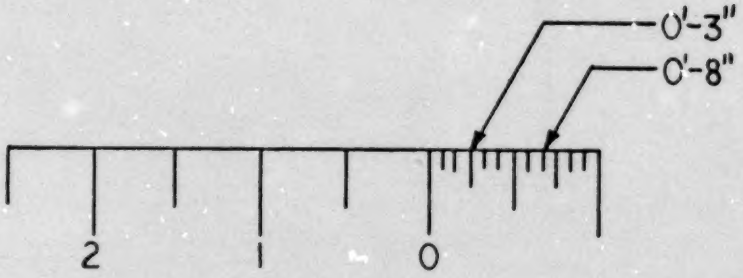
   This measurement is 2 feet.



2. Notice the small marks on the scale. Each mark represents 1 inch (1").

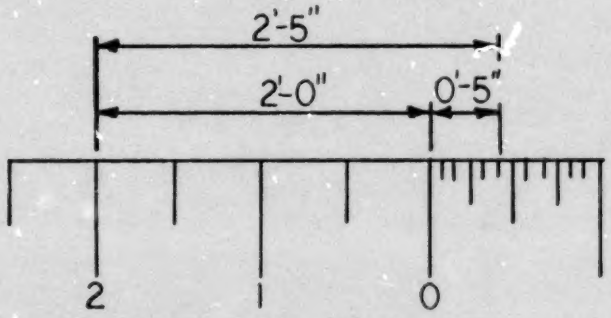
   To measure inches, start at the zero and measure to the right.

   These measurements are 3" and 8".



3. To review, this is how you read a 1/4" scale. You start the measurement at the zero and measure the number of feet to the left and the number of inches to the right of the zero.

   Here is an example of how you measure 2 foot and 5 inches (2' & 5").



STUDENT PAGE 2

MULTIPLICATION OF WHOLE NUMBERS

(Multiplication of Whole Numbers)

DRAFTING MATH 3

MULTIPLICATION OF WHOLE NUMBERS

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach multiplication of whole numbers.

b. What student learning problem(s) prompted the development of this technique?

Students do not know their times tables.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Quiz your students to see if they know their times tables. Ask them orally in class to answer such questions as what is 7 x 8, 9 x 6, 9 x 8, etc.

b. Have those students who do not know their multiplication tables complete the technique "Multiplication of Whole Numbers".

3. SUGGESTED RELATED ACTIVITIES:

Make up a bingo game using times tables.

MULTIPLICATION OF WHOLE NUMBERS

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Fill in the graph found on STUDENT PAGE 2. Study any of those times tables you don't know.

b. Work the problems found on STUDENT PAGE 3. Do not refer to the graph.

c. Return the graph and problems to your teacher.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 AND 3.

3. EXTRA THINGS THAT YOU CAN DO:

Make up flash cards for the times tables you don't know and have a friend quiz you after you have studied the cards.

MULTIPLICATION OF WHOLE NUMBERS

Fill in the multiplication graph below. Study any times tables you don't know.

X	2	3	4	5	6	7	8	9
2								
3								
4								
5								
6								
7								
8								
9								

STUDENT PAGE 2

MULTIPLICATION OF WHOLE NUMBERS

Complete all of following multiplication problems. Show all your math work.

1. $8 \times 6 =$ _____

2. $9 \times 7 =$ _____

3. $7 \times ? = 42$

4. $4 \times 7 =$ _____

5. $8 \times ? = 56$

6. $? \times 9 = 27$

7. $9 \times 4 =$ _____

8. $7 \times 9 \times 3 =$ _____

9. $\begin{array}{r} 48 \\ \times\ 23 \\ \hline \end{array}$

10. $\begin{array}{r} 73 \\ \times\ 15 \\ \hline \end{array}$

11. $\begin{array}{r} 625 \\ \times\ 105 \\ \hline \end{array}$

12. $\begin{array}{r} 805 \\ \times\ 32 \\ \hline \end{array}$

13. $\begin{array}{r} 7002 \\ \times\ 26 \\ \hline \end{array}$

14. $\begin{array}{r} 9078 \\ \times\ 58 \\ \hline \end{array}$

HOW TO FIND SQUARE FOOTAGE FROM AN ARCHITECTURAL FLOOR PLAN

(Square Footage)

DRAFTING MATH 4

HOW TO FIND SQUARE FOOTAGE FROM AN ARCHITECTURAL FLOOR PLAN

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the multiplication which is necessary in figuring square footage.

b. What student learning problem(s) prompted the development of this technique?

Students are unable to determine the total square footage of a house.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Give a demonstration on how to figure square footage.

b. Pass out to your class the worksheet of house floor plans for them to work on in class.

c. Those who seem to have difficulty will be asked to take an extra worksheet home to ask for their parents help.

3. SUGGESTED RELATED ACTIVITIES:

a. Ask your students to look in the Sunday real estate section of the newspaper and check the approximate square feet of different house plans.

b. Ask your students to figure the total square footage of the house they live in.

HOW TO FIND SQUARE FOOTAGE FROM AN ARCHITECTURAL FLOOR PLAN

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. With the help of your parents, read the information on STUDENT PAGE 2.

b. Work the problems on STUDENT PAGE 3.

c. Return your completed work to your teacher

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 AND 3.

3. EXTRA THINGS THAT YOU CAN DO:

a. Figure the square footage of your home.

b. Figure how much it would cost to build your house today at $50 a square foot.

c. Figure out the square footage of your backyard or patio.

HOW TO FIND SQUARE FOOTAGE FROM AN ARCHITECTURAL FLOOR PLAN

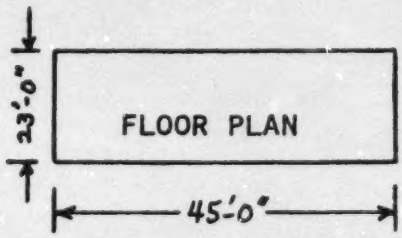
Parents:

In our architecture class there is a great need for students to have a working knowledge of what a good size home should be. They should also know what it would cost to build a home at today's contractor prices. Our students think nothing of building a 5,000 square foot house on a 50 foot wide city lot, which is very hard to do.

In order to reinforce the teacher's instruction we would like for you to take a few minutes to review this math skill with your son or daughter.

1. Example of finding the floor plan size in square feet:

   a. To find the area (square footage) multiply the length times the width in feet, if possible.




```
  45
x 23
 135
 90
1035
```

ANSWER: 1035 Sq. Ft.

   b. If the total cost to build this house is asked for, multiply the square footage times the cost per square foot. Example from the floor plan above:

   Cost to build = 1035 Square Feet times cost.

```
  1035 Square Feet
x  $52
 2070
 5175
$53820
```

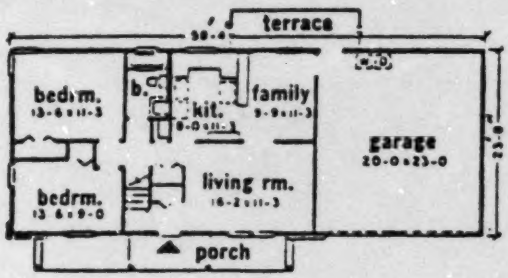
ANSWER: $53,820

HOW TO FIND SQUARE FOOTAGE FROM AN ARCHITECTURAL FLOOR PLAN

WORKSHEET

Figure the square footage on the three (3) floor plans below and the total cost at $52 per square feet.

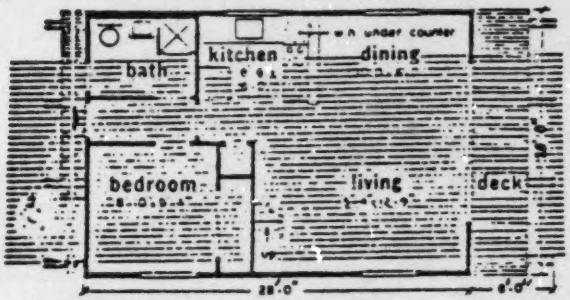
a.



a. SQ. FT. _____

COST: _____

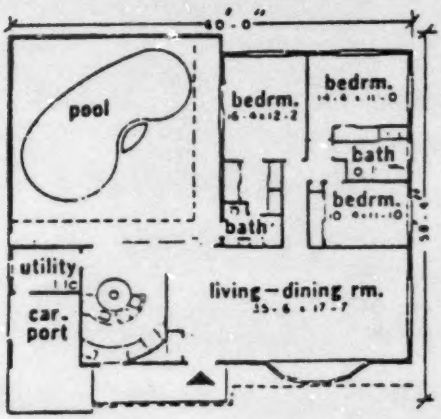
b.



b. SQ. FT. _____

COST: _____

c.



c. SQ. FT. _____

COST: _____

4.4

HOW TO FIND SQUARE FOOTAGE FROM AN ARCHITECTURAL FLOOR PLAN

(1)

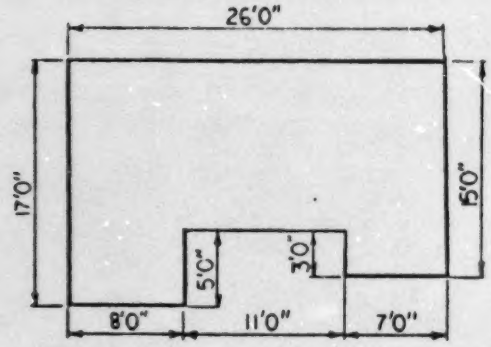


Figure the approximate total square footage in this floor plan.

1 _____ sq.ft.

(2)

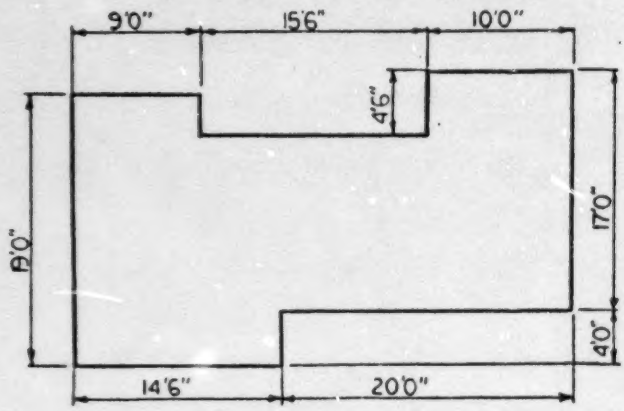


Figure the total square footage and cost of this floor plan at $52/sq. ft.

2A _____ sq.ft.

2B cost= _____

(3)

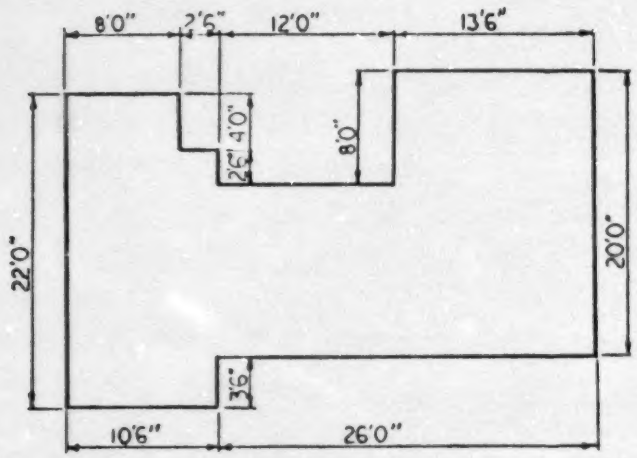


Figure the approximate total square footage in this floor plan.

3 _____ sq.ft.

TWO PLASTIC TRIANGLES USED AS DRAFTING TOOLS

(Degrees and Angles)

DRAFTING MATH 5

TWO PLASTIC TRIANGLES USED AS DRAFTING TOOLS

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach addition and subtraction of the degrees of angles using two basic drafting triangles.

b. What student learning problem(s) prompted the development of this technique?

Students are unable to combine triangles to solve different degree settings for uncommon angles of 15, 75, or 135 degrees.

2. TEACHER INSTRUCTIONS:

a. Explain how many degrees there are within any circle, square or triangle.

b. Show your students the two basic triangles used in drafting classes the 45° and the 30° - 60° triangles. Explain how the triangles are used with a T-square to form 15°, 75°, 105° angles, etc.

c. Pass out the Information Handout to your students which will further explain how different angles can be formed.

d. When your students understand this concept give them the student assignment to complete.

3. SUGGESTED RELATED ACTIVITIES:

Provide a drawing to your students where they have to figure several different angles.

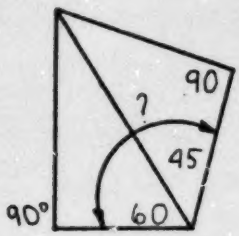
TWO PLASTIC TRIANGLES USED AS DRAFTING TOOLS

INFORMATION HANDOUT

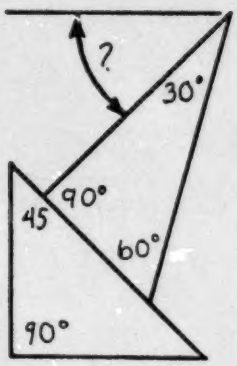
Triangles are made of clear plastic and are various sizes. The triangles most commonly used in making shop drawings are the 45 degree triangle and the 30-60 degree triangle. Using one or both of these triangles and the T-square, helps the drafter to draw lines or angles at any 15 degree segment around the outside surface of any circle.

The use of these combinations of triangles to obtain the desired angle will become very easy with a little practice.

Study the following examples. Remember you are using the same two triangles used in our drafting classes, the 45 and the 30-60 degree triangle.

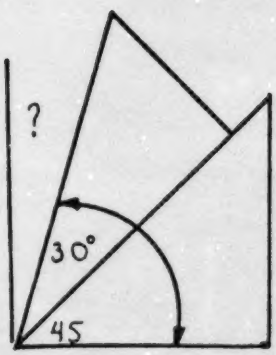


$60^0 + 45^0 = \underline{\underline{105^0}}$



$45^0 + 90^0 = 135^0$

$180^0 - 135^0 = \underline{\underline{45^0}}$



DAVID BOATMAN
SACRAMENTO HIGH

$30^0 + 45^0 = 75^0$

$90^0 - 75^0 = \underline{\underline{15^0}}$

TWO PLASTIC TRIANGLES USED AS DRAFTING TOOLS

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Work the problems found on STUDENT PAGE 2 and write the answers on STUDENT PAGE 3.

b. Return your worksheet and answer sheet to your teacher.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 AND 3.

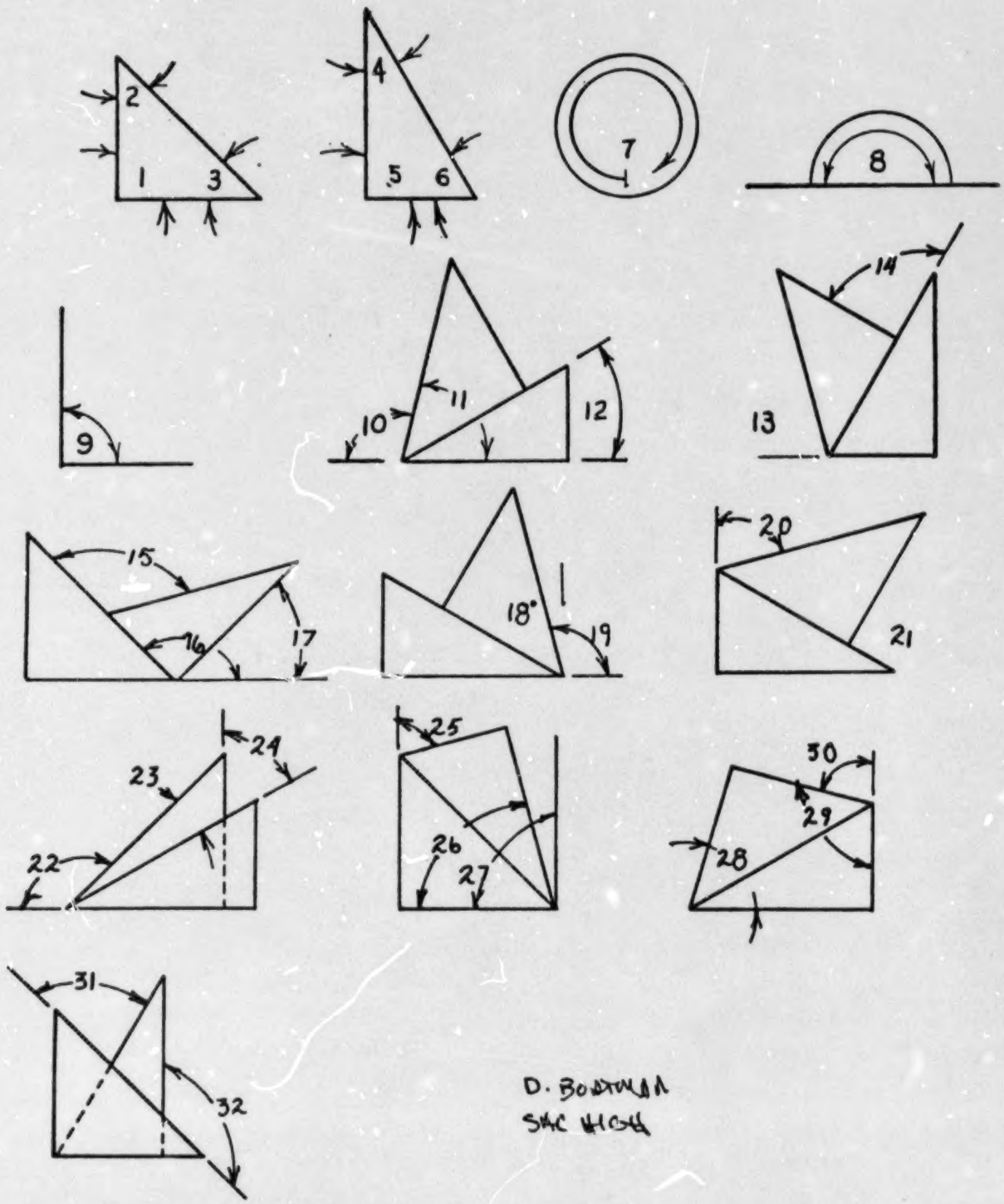
3. EXTRA THINGS THAT YOU CAN DO:

a. Draw different angles, such as 15°, 75°, etc., on a sheet of paper. Check your answer with a protractor.

b. Draw a circle and divide the circle into 24 equal parts using a T-square and two triangles.

TWO PLASTIC TRIANGLES USED AS DRAFTING TOOLS

DIRECTIONS: Figure the angles shown on numbers 1-32. Write your answers on the answer sheet found on STUDENT PAGE 3.



D. BOARMAN
SAC HIGH

ANSWER SHEET

TWO PLASTIC TRIANGLES USED AS DRAFTING TOOLS

1 90°	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32

CENTERING A DRAFTING ISOMETRIC PROBLEM

(Measuring)

DRAFTING MATH 6

CENTERING A DRAFTING ISOMETRIC PROBLEM

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the mathematics involved in placing a given object in the center of a drafting sheet.

b. What student learning problem(s) prompted the development of this technique?

Students cannot center isometric drawings on drafting paper.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Demonstrate on the blackboard how to center a given object. Be sure to include a discussion on how to divide fractions.

b. After your demonstration pass out to your students the technique on centering isometric drafting problems. This will reinforce your instruction.

c. Have your students read over the handout and work the problems. Your students will need drafting paper and supplies to complete the assignment.

d. Ask your students to return the problems to you when they are finished.

3. SUGGESTED RELATED ACTIVITIES:

Encourage your students to center drawings on many different sizes of drafting paper.

CENTERING A DRAFTING ISOMETRIC PROBLEM

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. Read over the example on centering an isometric drafting problem found on STUDENT PAGES 2 AND 3.

b. Work the problems on STUDENT PAGE 4. You will need drafting paper, a T-square, a 30-60 degree triangle, and maybe a ruler.

c. Return the completed assignment to your teacher.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 - 4.

3. EXTRA THINGS THAT YOU CAN DO:

When you sketch objects freehand try to sketch them at 30 degree angles and they will look very realistic.

These are the steps to follow when centering an object on a sheet of paper.

Step 1: Find the height, width and length of the object you are going to center. On the example below the dimensions are:

Height - 2 1/2"
Width - 1 1/2"
Length - 4 1/4"

Step 2: Locate the center of your paper, You can do this by drawing diagonal lines from the corners of the paper or measure to find the center. Mark the center.

Step 3: From the center mark, draw a straight line down vertically 1/2 the height of the object.

Step 4: Draw a line horizontal to the first line.

Step 5: From the bottom of your first line draw another line to the left at a 30 degree angle 1/2 the width of the object.

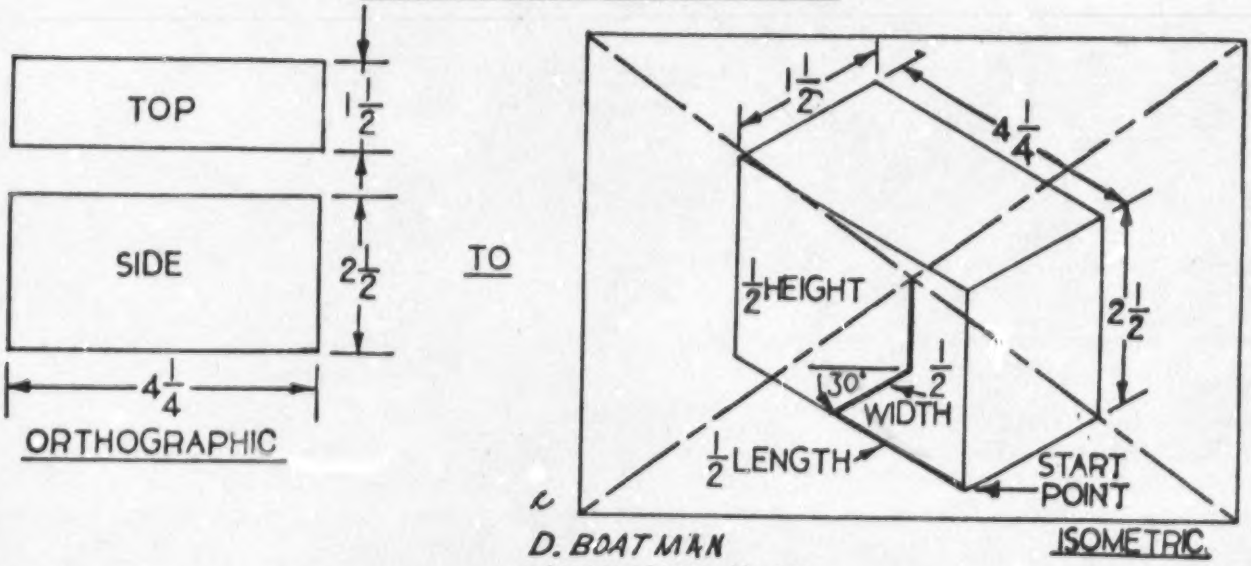
Step 6: Draw another horizontal line.

Step 7: Draw another line to the right at a 30 degree angle 1/2 the length of your object.

Step 8: You can now complete the drawing. (Dimensions are sometimes placed on drawings).

An enlarged example is found on STUDENT PAGE 3.

-- EXAMPLES NOT DRAWN TO SCALE --



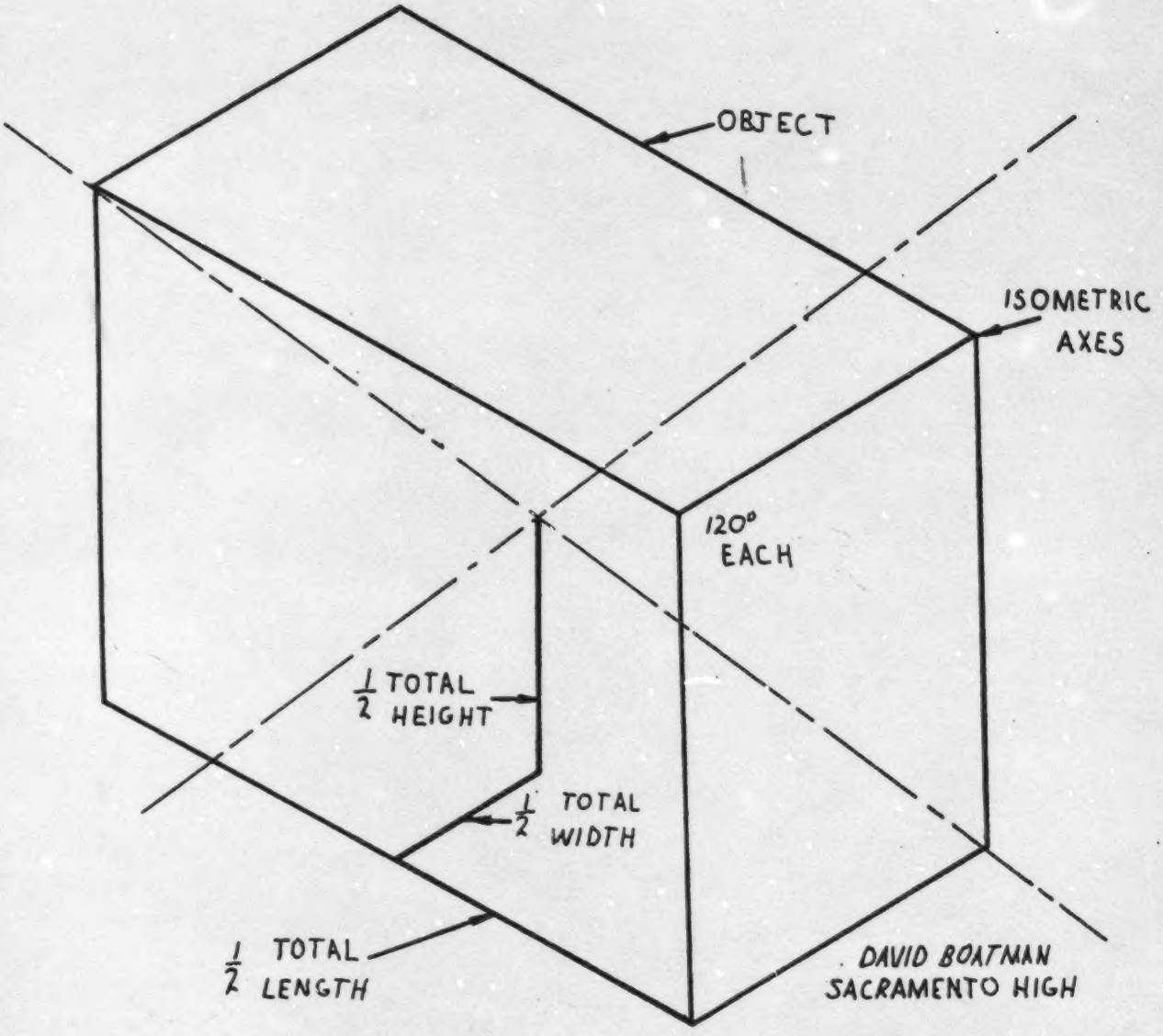
D. BOATMAN
SACRAMENTO HIGH

STUDENT PAGE 2

6.3

CENTERING THE ISOMETRIC OBJECT

EXAMPLE SHEET



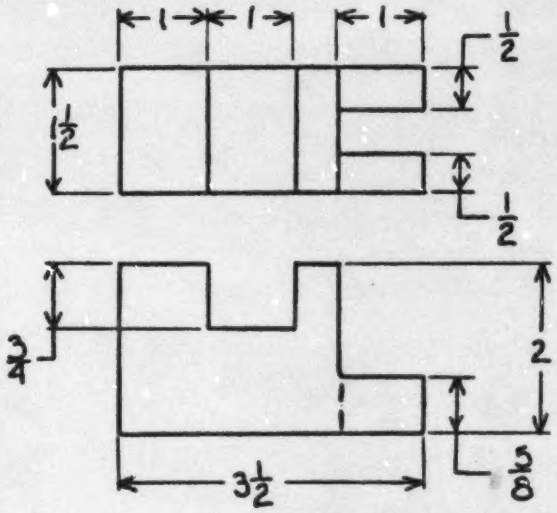
STUDENT PAGE 3

6.4

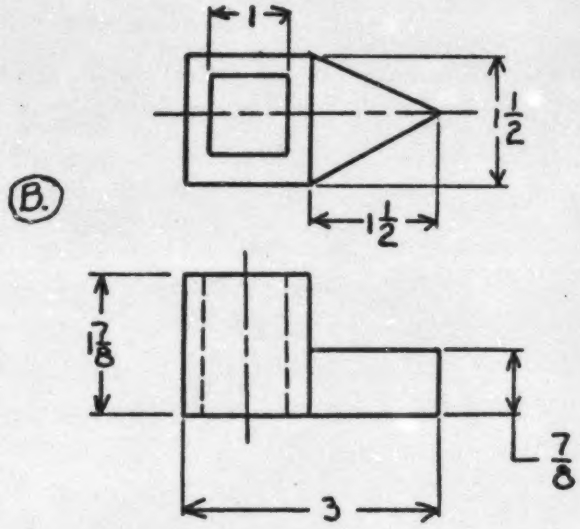
CENTERING A DRAFTING ISOMETRIC PROBLEM

DIRECTIONS: Using drafting paper, center these objects. Please draw full scale.

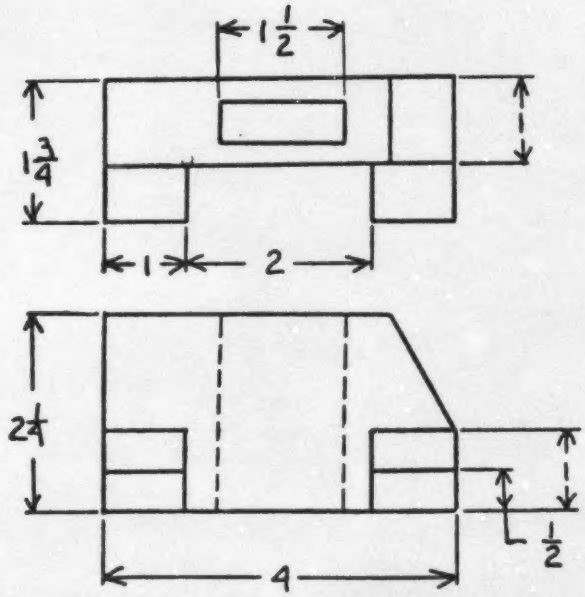
A.



B.



C.



CKM^{c} CLATCHY
PERRY EASTHAM

A QUICK WAY TO FIGURE RADIUS SETTINGS WHEN USING THE DRAFTING COMPASS

(Compass Settings)

DRAFTING MATH 7

A QUICK WAY TO FIGURE RADIUS SETTINGS

WHEN USING THE DRAFTING COMPASS

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the math skills required to determine the radius when the diameter of a circle is given.

b. What student learning problem(s) prompted the development of this technique?

Students are unable to figure radius settings when using a drafting compass.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Demonstrate how to draw a circle using a compass. Show the relationship of the radius when drawing a circle of a certain diameter.

b. Using the attached student technique explain the math involved in determining the radius.

c. After you have explained each of the three methods give your students time to work the problems.

d. Have your students return the finished problems to you.

3. SUGGESTED RELATED ACTIVITIES:

Have your students apply this technique to classroom drafting problems.

7.1

A QUICK WAY TO FIGURE RADIUS SETTINGS WHEN USING THE DRAFTING COMPASS

STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. This technique will teach you the math required to figure the radius of a circle when the diameter is given. Once you have the radius of a circle you can set your compass and draw the circle, arc, etc.

b. Read each of the three methods and work out the problems.

c. Return your finished work to your teacher.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 - 5.

3. EXTRA THINGS THAT YOU CAN DO:

Use this technique to make compass settings on your drafting assignments.

A QUICK WAY TO FIGURE RADIUS SETTINGS

WHEN USING THE DRAFTING COMPASS

In order to draw any size arc, circle, drilled hole, etc. you have to know how to make compass settings. A compass setting is based on the radius which is 1/2 the diameter. See the illustration below.

The diameter may be give to you as a:

1. whole number
2. odd whole number with fraction
3. even whole number with fraction
4. fraction

This technique will show you how to divide these numbers in half so that you can find the radius, set your compass and draw the circle, arc, etc.

A QUICK WAY TO FIGURE RADIUS SETTINGS

WHEN USING THE DRAFTING COMPASS

FIRST EXAMPLE: To find the radius of a odd whole number with fraction follow these steps:

DIAMETER: 3 3/4"

Step 1: Take 1/2 of the whole number, 3. (Divide 2 into 3).

$2\overline{)3}$ $\quad 1$, $\quad 2$, $\quad 1$ Forget remainder

ANSWER = 1

Step 2: Add upper and lower numbers of the fraction together to obtain the numerator (upper part) of the fraction in the answer.

$\frac{3}{4}$ = fraction

3 + 4 = 7

ANSWER = $1\ \frac{7}{?}$

Step 3: Multiply the bottom number of the given fraction by 2 to obtain the denominator (bottom part) of the fraction in the answer.

$\frac{3}{4}$ = fraction

2 x 4 = 8

ANSWER = $1\ \frac{7}{8}$

The compass setting for a 3 3/4" diameter circle is 1 7/8" radius.

Find the compass settings for the following measurements using the method explained above.

5 1/2 dia.	_____	21 3/16 dia.	_____
11 5/8 radius	_____	7 3/8 dia.	_____
33 11/16 dia.	_____	1 7/8 dia.	_____

STUDENT PAGE 3

A QUICK WAY TO FIGURE RADIUS SETTINGS

WHEN USING THE DRAFTING COMPASS

SECOND EXAMPLE: To find the radius of an even whole number with fraction follow these steps:

DIAMETER: 2 1/2"

Step 1: Take 1/2 of the whole number 2.

$$2\overline{)2} = 1, \quad 2 - 2 = 0$$

ANSWER = 1

Step 2: Do not change the upper number of the fraction. Bring over this number to form the top of the new fraction.

1 = upper number of $\frac{1}{2}$ ANSWER = $1\frac{1}{?}$

Step 3: Multiply the bottom number of the original fraction by 2.

2 = bottom number of $\frac{1}{2}$ ANSWER = $1\frac{1}{4}$

2 x 2 = 4

The compass setting for a 2 1/2" diameter circle is 1 1/4" radius.

Find the compass setting for the following measurements using the method explained above.

8 5/8 dia. _____	6 13/16 radius _____
12 7/8 dia. _____	4 3/4 dia. _____
24 1/8 dia. _____	18 29/16 dia. _____

A QUICK WAY TO FIGURE RADIUS SETTINGS

WHEN USING THE DRAFTING COMPASS

THIRD EXAMPLE: To find the radius of a fraction follow these steps:

DIAMETER: 3/4"

Step 1: Multiply the bottom number by 2.

$\frac{3}{4}$ dia. = $\frac{3}{4 \times 2}$ = $\frac{3}{8}$ ANSWER = $\frac{3}{8}$ radius

Find the compass settings for the following measurements using the method explained above.

1/2 dia.	_____	1/4 dia.	_____
13/16 dia.	_____	3/8 dia.	_____
5/8 dia.	_____	5/16 radius	_____
3 5/8 dia.	_____	12 3/4 dia.	_____
3/16 dia.	_____	10 7/8 dia.	_____
13 3/8 dia.	_____	33 5/16 dia.	_____
5/16 dia.	_____	15/16 dia.	_____
22 3/16 dia.	_____		

USING FRACTIONS AND DECIMALS IN THE DRAFTING CLASS

(Converting Fractions to Decimals)

DRAFTING MATH 8

USING FRACTIONS AND DECIMALS

IN THE DRAFTING CLASS

TEACHER MATERIALS:

1. CONCEPTS OF TECHNIQUE:

a. What SKILL will this technique teach?

This technique will teach the math skill of converting fractions to decimals.

b. What student learning problem(s) prompted the development of this technique?

Many students have forgotten this skill from lack of use or have not been taught this method of finding decimals.

2. TEACHER INSTRUCTIONS FOR THE USE OF THIS TECHNIQUE:

a. Present a lesson on the conversion of fractions to decimals. Include a discussion on rounding off numbers.

b. Have your students study the accompanying material and work the problems.

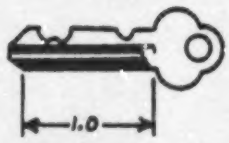
c. Check answers and review any problems that are incorrect.

3. SUGGESTED RELATED ACTIVITIES:

Give your students a list of decimals to convert to fractions.

USING FRACTIONS AND DECIMALS

IN THE DRAFTING CLASS



STUDENT MATERIALS:

1. STUDENT INSTRUCTIONS:

a. The materials in this packet will help you convert fractions to decimals.

b. Read and study the materials on STUDENT PAGE 2.

c. Work all problems found on STUDENT PAGE 3.

d. Have your teacher correct your answers.

e. Review your problems to see where you made mistakes.

2. STUDENT ASSIGNMENT:

Your assignment is found on STUDENT PAGES 2 AND 3.

3. EXTRA THINGS THAT YOU CAN DO:

Practice this skill with different fractions and let your teacher check your work.

USING FRACTIONS AND DECIMALS

IN THE DRAFTING CLASS

Let's start by using the fraction of $\frac{1}{8}$. Remember that the top number of a fraction is called the numerator and the bottom number of a fraction is called the denominator. To find the decimal equivalent, you divide the numerator by the denominator or if you forget the names of the numbers, divide the bottom number into the top number.

$\frac{1}{8}$ = 8)1

You now notice 8 does not divide into 1, so you add a decimal point behind the one and add three (3) zeros.

8)1.000

Remember to move the decimal point up for your answer.

8)1.000

Now you are ready to divide.

```
   .125
8)1.000
   8
  20
  16
   40
   40
```

You read your answer as one hundred twenty five thousandths.

USING FRACTIONS AND DECIMALS

IN THE DRAFTING CLASS

Find the decimal equivalents for the following fractions. (Write your answers so that they have three decimal places.)

1.) $\frac{1}{4}$ =

2.) $\frac{3}{8}$ =

3.) $\frac{7}{8}$ =

4.) $\frac{3}{4}$ =

5.) $\frac{1}{2}$ =

6.) $\frac{5}{8}$ =

7.) $\frac{3}{32}$ =

8.) $\frac{5}{16}$ =

9.) $\frac{3}{16}$ =

10.) $\frac{7}{32}$ =

11.) $\frac{9}{16}$ =

12.) $\frac{7}{16}$ =

STUDENT PAGE 3

THE FOLLOWING INDUSTRIAL EDUCATION BASIC SKILL INSTRUCTIONAL TECHNIQUES ARE AVAILABLE FROM:

VOICE (VOCATIONAL OCCUPATIONAL INFORMATION CENTER FOR EDUCATORS)

721 CAPITOL MALL
SACRAMENTO, CALIFORNIA 95814

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"LEARNING TO DO MATH THE AUTOMOTIVE WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE AUTOMOTIVE WAY"

"LEARNING TO READ AND WRITE THE WOODWORKING WAY"
"LEARNING TO DO MATH THE WOODWORKING WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE WOODWORKING WAY"

"LEARNING TO READ AND WRITE THE METALWORKING WAY"
"LEARNING TO DO MATH THE METALWORKING WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE METALWORKING WAY"

"LEARNING TO READ AND WRITE THE ELECTRONICS WAY"
"LEARNING TO DO MATH THE ELECTRONICS WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE ELECTRONICS WAY"

"LEARNING TO READ AND WRITE THE DRAFTING WAY"
"LEARNING TO DO MATH THE DRAFTING WAY"
"LEARNING TO VERBALLY & VISUALLY COMMUNICATE THE DRAFTING WAY"